University of California
Lawrence Livermore National Laboratory

Engineering Directorate

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The Engineering Directorate puts science into action, working with Livermore's programs to solve problems of national importance

Mission

The Engineering Directorate works in partnership with all laboratory programs as well as with outside research organizations and industry to make the technological breakthroughs needed to solve problems of national importance.

Engineering Integrated with Programs

Unique among the national laboratories, Livermore has a large central engineering organization composed of 2100 engineers, technicians, and support people. More than 80% of these people are assigned to specific laboratory projects, often as complete engineering divisions, where they work alongside program scientists in multidisciplinary teams. These engineering divisions are critical to the success of these projects and are the *raison d'être* for the existence of the Engineering Directorate. About 10% of Engineering's staff and resources are dedicated to maintaining and enhancing the core technologies and unique engineering facilities. In this core engineering research, we anticipate and develop the technologies, tools, and facilities that will be required by future laboratory programs. Often, this work creates new opportunities for Livermore to contribute to emerging national needs and develops technologies that spin off into new programs and centers of excellence, as has happened in such areas as advanced manufacturing technology, transportation technologies, imaging science, nuclear systems safety, and health care technology. As program goals are met or needs change, the engineering teams are reassembled and reassigned, allowing the laboratory to respond effectively to changing national needs.

Engineering Core R&D

Livermore's Engineering Directorate is a multidisciplinary organization with expertise in the major engineering fields. We develop and simulate engineering systems, improve their designs, and then test their performance when built. We manage large- and small-scale projects requiring complex interactions of many scientific disciplines. In support of these activities, we have research and development efforts in the following core technologies:

- Computational electronics and electromagnetics
- Computational mechanics
- Power conversion technologies
- Information engineering
- Materials science and engineering
- Nondestructive evaluation
- Microtechnology
- Precision fabrication and manufacturing

Benefits to the Nation

The Livermore matrix style of program and laboratory management, with a strong engineering component, is a legacy of E. O. Lawrence, who pioneered the multidisciplinary team approach to applied research. It remains to this day a key factor in Livermore's outstanding successes in such programs as uranium enrichment by laser isotope separation, the design and construction of the Nova laser, the

engineering design of the National Ignition Facility, and the design and construction of the Flash X-Ray Facility (one of the nations premier diagnostic tools for science-based stockpile stewardship to assure the continuing safety and reliability of the stockpile without nuclear testing). Engineering development of precision metrology and precision diamond machining helped to develop U.S. industrial strength in areas as diverse as computer disks and contact lenses.

Major Accomplishments

- Engineering development and plant-scale demonstration of the atomic vapor laser isotope separation (AVLIS) process for uranium enrichment.
- Engineering design and construction of the Nova laser and the Flash X-Ray facility; engineering design work for the proposed National Ignition Facility.
- Continuing development of precision fabrication, including diamond machining and grinding and nanoscale fabrication.
- Development, in collaboration with biotechnology researchers, of a series of high-speed flow cytometers for sorting biological cells and cell components.
- Development of structural-mechanics codes, including CAST2D, DYNA, NIKE, ParaDyn, PING, SAND, and TOPAZ.
- Development of nondestructive inspection methods, including infrared computed tomography and laser-generated ultrasonics.
- Science and technology of structural materials, including materials processing, bonding and adhesion, and tailoring and prediction of materials properties.

Technical Excellence

In Livermore's early years, technical challenges posed by the nuclear weapons program attracted some of the nation's most talented engineers and scientists to Livermore. This legacy continues today with the challenges posed by our current programs. Many of our engineers have received national and international recognition for excellence in their technical fields.

Livermore has a large number of unique fabrication and test facilities, many of them developed initially for national-security work. Among these facilities are laboratories for nondestructive evaluation, for microfabrication of electronic and mechanical components on the nanometer scale, and for precision machining, including a large optics diamond machining facility that is unique in the world.

The Engineering Directorate brings together, in one square mile, the technical expertise and the facilities needed to tackle almost any kind of engineering problem. Applied in multidisciplinary, multiprogram project teams that produce working prototypes from scientific concepts, these resources give Livermore a capability for scientific problem-solving and technical innovation that is unmatched anywhere in the nation or the world.

Contact

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